



ADDIS ABABA UNIVERSITY

COLLEGE OF HEALTH SCIENCE

SCHOOL OF PUBLIC HEALTH

ASSESSMENT OF MALNUTRITION AND ASSOCIATED FACTORS AMONG
PREGNANT WOMEN ATTENDING PRENATAL CARE IN MEKELLE
GENERAL HOSPITAL, TIGRAY, NORTHERN ETHIOPIA.

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Abbreviation and Acronyms

ANC	Antenatal Care
BMI	Body Mass Index
CI	Confidence Intervals
DDS	Dietary Diversity Score
DOHaD	Developmental Origins of Health and Disease
EDHS	Ethiopian Demographic and Health Survey
HSTP	Health Sector Transformation Plan
LBW	Low Birth Weight
LMICs	Low- and Middle-Income Countries
MGH	Mekelle General Hospital
MUAC	Mid-Upper Arm Circumference
NCDs	Non-Communicable Diseases
NNP	National Nutrition Program
OR	Odds Ratio
SDGs	Sustainable Development Goals
SES	Socio-Economic Status
SGA	Small-for-Gestational-Age
UNICEF	United Nations International Children's Emergency Fund
UNOCHA	United Nations Office for the Coordination of Humanitarian Affairs
WHO	World Health Organization

Abstract

Background: Malnutrition during pregnancy is a critical public health issue that can adversely affect maternal and fetal health. Despite advancements in prenatal care, many pregnant women continue to experience malnutrition, characterized by undernutrition or overnutrition (obesity). Malnutrition during pregnancy is a pressing global health concern, affecting approximately 20 million women worldwide annually. In Ethiopia, the situation is particularly alarming, with a reported prevalence of undernutrition among pregnant women reaching 25%. Malnutrition contributes to significant adverse outcomes, including maternal mortality, low birth weight, and developmental delays in children. Approximately 1 in 4 births in Ethiopia is affected by low birth weight, illustrating the critical need for targeted interventions in prenatal care settings.

Objectives: the aim of this study is to assess the prevalence of malnutrition and identify the associated factors among pregnant women attending prenatal care at Mekelle General Hospital.

Methods: An institutional based cross-sectional study was conducted in prenatal clinics over a three-month period a study was conducted in Mekelle. The healthcare infrastructure in Mekelle includes one teaching referral hospital, seven general hospitals, and nine health centers, complemented by 48 privately owned clinics. A sample of 408 pregnant women was selected using random sampling. Data was collected through structured questionnaires and anthropometric measurements including (BMI, and MUAC). Nutritional status was classified based on WHO guidelines. Statistical analyses included descriptive statistics, chi-square tests for associations, and logistic regression to identify risk factors.

Result: The overall prevalence of malnutrition among pregnant women was 41.2% (95% CI: 36.4–46.0). Regarding dietary practices, the majority of participants (92.7%) consumed only 1–2 food groups, and only 7.3% consumed 3–4 food groups. Most participants (75.7%) ate three meals daily, but a large proportion reported low intake of iron-rich (69.8%) and dairy foods (51.2%), while 82.8% consumed vitamin-rich foods daily. Multiple logistic regression analysis showed that urban residence (AOR: 0.32, 95% CI: 0.13–0.80), being married (AOR: 0.46, 95% CI: 0.23–0.92), having three or more children (AOR: 0.52, 95% CI: 0.28–0.96), initiating ANC in the second trimester or earlier (reference), and consuming 3–4 food groups (AOR: 0.39, 95% CI: 0.16–0.97) were negatively associated with malnutrition. In contrast, having a husband with only secondary education (AOR: 1.92, 95% CI: 1.19–3.08) and starting ANC in the third trimester (AOR: 5.87, 95% CI: 1.07–32.17) were positively associated with malnutrition.

Conclusion: The study found a high prevalence of malnutrition in the study area. Malnutrition was significantly associated with residence, marital status, husband's educational level, parity, timing of first ANC visit, and dietary diversity. Therefore, strategies and programs aimed at reducing malnutrition should focus on improving maternal dietary practices, promoting early ANC attendance, enhancing male involvement through

education, and strengthening nutrition counseling at all levels. Furthermore targeted health information and support services are essential to improve the nutritional status of pregnant women.

Keywords: Malnutrition, Pregnant women, prenatal care, Dietary diversity, Socio-demographic factors, Ethiopia

1. Introduction

1.1 Background

Malnutrition is a major public health concern affecting millions of individuals' worldwide, particularly vulnerable groups such as pregnant women and children. It encompasses a range of conditions including undernutrition, micronutrient deficiencies, and obesity, all of which can severely impact maternal and child health outcomes. In 2023, between 713 and 757 million people faced hunger, while over 2.33 billion experienced food insecurity, with severe food insecurity affecting 864 million individuals. Economic disparities exacerbate the issue, as 71.5% of people in low-income countries could not afford a healthy diet in 2022 (1).

Globally, maternal malnutrition continues to be a significant public health issue, particularly in low- and middle-income countries. According to the World Health Organization (WHO) 2021, an estimated 150 million women worldwide suffer from undernutrition, with the highest burden observed in sub-Saharan Africa and South Asia (2). The World Health Organization (WHO) estimates that approximately 15% of pregnant women globally suffer from some form of malnutrition, leading to adverse health consequences for both mothers and their infants (3). Globally, malnutrition during pregnancy is associated with various complications such as increased maternal morbidity and mortality, low birth weight, preterm birth, and developmental delays in children (4). According to a UNICEF report, around 20 million pregnant women are estimated to be undernourished, with significant proportions experiencing micronutrient deficiencies like iron, folate, and vitamin A (5). These deficiencies can lead to severe health complications; for instance, anemia affects approximately 38% of pregnant women worldwide (6).

Globally, various policies and programs have been implemented to combat malnutrition. The United Nations' Sustainable Development Goals (SDGs), particularly Goal 2 ("zero hunger"), aims to end hunger, achieve food security and improved nutrition, and promote sustainable agriculture by 2030 (7). To this end, the WHO has launched initiatives such as the Global Nutrition Target 2025, which includes targets to reduce stunting and wasting in children under five years of age, as well as addressing anemia in women of reproductive age (8). These global initiatives underscore the importance of nutrition in health systems and emphasize the need for multisectoral approaches that integrate health, agriculture, education, and social protection.

In Africa, the prevalence of malnutrition among pregnant women is alarmingly high. The WHO reports that about 20% of pregnant women in the region suffer from malnutrition (9). Sub-Saharan Africa faces unique challenges contributing to this high prevalence, including food insecurity, poverty, and limited access to healthcare services. A study conducted in Nigeria found that nearly 30% of pregnant women were undernourished, highlighting the urgent need for targeted nutritional interventions (10). Furthermore, the

prevalence of anemia among pregnant women in Africa is estimated at 50%, with some regions reporting even higher rates (11).

In Ethiopia, malnutrition remains one of the leading public health concerns. The Ethiopian Demographic and Health Survey (EDHS) 2019 reports that approximately 22% of women of reproductive age are underweight (12). National studies indicate that approximately 25% of pregnant women experience some form of malnutrition (13). The Ethiopian Demographic and Health Survey (EDHS) reported that 22% of pregnant women are anemic, with significant regional disparities across the country (14). For example, in rural areas, the prevalence of anemia can exceed 30%, driven by factors such as inadequate dietary diversity and poor access to healthcare services (15).

The government has implemented several policies and programs to address malnutrition, including the National Nutrition Program (NNP). The NNP, first introduced in 2008 and updated in 2016, focuses on improving maternal and child nutrition by promoting dietary diversity, supplementation, and fortification (16). Additionally, the Health Sector Transformation Plan (HSTP) prioritizes nutrition-sensitive interventions, aiming to reduce maternal and child malnutrition through integrated healthcare services (17). Despite these efforts, malnutrition persists due to challenges such as food insecurity, inadequate healthcare access, and socio-political factors.

In addition to anemia, other forms of malnutrition, including stunting and wasting, are prevalent among pregnant women in Ethiopia. A study conducted in the Amhara region revealed that about 18% of pregnant women were underweight (18). These statistics illustrate the urgent need for focused research on malnutrition among pregnant women in Ethiopia, particularly in light of the country's ongoing challenges related to food security and health service delivery.

The Tigray region, where Mekelle General Hospital is located, has been particularly affected by malnutrition among pregnant women. Recent reports indicate that the prevalence of malnutrition in this region can reach as high as 30%, exacerbated by socio-political instability and conflict that has disrupted food supply chains and healthcare access (19). According to the Tigray Regional Health Bureau, nutritional support services for pregnant women have been severely affected, leading to increased rates of malnutrition and associated health complications (20). The conflict, which began in late 2020, has led to widespread displacement, loss of livelihoods, and disruption of healthcare services. Reports indicate that food insecurity has sharply increased in Tigray due to blockades and destruction of agricultural resources (21). The conflict has disrupted healthcare services, destroyed critical infrastructure, and displaced millions of people, leading to widespread food insecurity and limited access to essential prenatal care and led to significant socioeconomic consequences (22).

According to the United Nations Office for the Coordination of Humanitarian Affairs (UNOCHA), nearly 2.3 million people in Tigray face acute food insecurity, with pregnant and lactating women being among the most affected groups (23). Pregnant women in conflict-affected areas face increased risks of undernutrition due to reduced dietary intake, lack of healthcare access, and psychological stress (24).

1.2. Statement of the Problem

Malnutrition remains a pressing global public health issue, with far-reaching implications for maternal and child health. The World Health Organization (WHO) estimates that over 462 million adults are underweight globally, and malnutrition contributes to nearly 45% of deaths in children under five (25). In Sub-Saharan Africa, where food insecurity and healthcare access remain critical challenges, maternal undernutrition affects approximately 20%-25% of pregnant women (26). Despite global initiatives such as the Sustainable Development Goals (SDGs), which aim to eradicate malnutrition by 2030, progress is uneven and slower in low-income countries like Ethiopia (27).

Globally, the causes of malnutrition during pregnancy are multifaceted. Key contributors include poverty, inadequate dietary intake, limited access to healthcare, and cultural or traditional food practices that restrict the consumption of essential nutrients (28,29). In Ethiopia, approximately 38% of households are food insecure, and cultural norms often limit pregnant women's intake of protein-rich foods, further increasing their vulnerability to undernutrition (30,31). Additionally, conflict and displacement in regions like Tigray have compounded these challenges, leaving millions without adequate food or healthcare (32).

The consequences of maternal malnutrition are severe, affecting both mothers and their children. Pregnant women who are undernourished are at higher risk of anemia, obstructed labor, and infections, which can lead to maternal mortality. For children, maternal malnutrition increases the likelihood of preterm birth, low birth weight, and neonatal death. Long-term consequences include stunted growth, poor cognitive development, and a higher risk of chronic diseases such as diabetes and hypertension (33,34). In Ethiopia, neonatal mortality rates remain high at 33 deaths per 1,000 live births, many of which are linked to maternal malnutrition (35).

In Ethiopia, the burden of maternal malnutrition is significant. Recent national surveys report that 24% of women of reproductive age are undernourished, with even higher rates in conflict-affected regions such as Tigray (36,37). Studies from Northern Ethiopia indicate that the prevalence of maternal undernutrition ranges between 20%-30%, with factors such as poverty, limited dietary diversity, and food insecurity playing significant roles (19). Additionally, the conflict in Tigray has exacerbated malnutrition by disrupting food supply chains, healthcare services, and livelihoods (22,28).

Despite the severity of the issue, there are gaps in the existing literature on the prevalence of malnutrition and its associated factors among pregnant women in Ethiopia, particularly in conflict-affected regions like Tigray. Existing studies have primarily focused on child malnutrition or broader maternal health issues, with limited emphasis on the specific challenges and determinants of malnutrition during pregnancy. For instance, many

studies fail to account for the impact of cultural practices on maternal nutrition (19,32,35), while some others have not adequately addressed the role of ongoing conflicts and socioeconomic disruptions in shaping nutritional outcomes (28,37,38).

Therefore, this study differs from previous research by focusing on a conflict-affected region and on specific socio-demographic factors (e.g., age, education, income, residence) and healthcare-related factors (e.g., antenatal care visits, access to facilities, nutritional counseling, and supplementation) and addresses the cultural practices on maternal nutrition by assessing dietary practices and diversity scores, exploring food consumption patterns and nutrient intake in the local context of Tigray in pregnant women at Mekelle General Hospital.

1.3. Significance of the Study Findings

Addressing a Public Health Concern

Malnutrition during pregnancy is a critical public health issue, particularly in low- and middle-income countries (LMICs). Pregnant women face increased nutritional needs to support fetal development, and malnutrition can lead to severe health outcomes, including maternal mortality, low birth weight, and developmental delays in children. This study assesses the prevalence of malnutrition among pregnant women attending prenatal care, providing essential data to inform targeted interventions for improved maternal and child health.

Contribution to Public Health Policy

The findings provide essential, evidence-based data that can inform local and national health policies aimed at improving maternal and child health. By identifying the prevalence of malnutrition and associated risk factors such as socioeconomic status, education level, and access to healthcare, policymakers can develop targeted interventions. This data will enable governments and health organizations to allocate resources effectively, design programs that address specific needs, and implement strategies to reduce malnutrition among pregnant women, particularly in high-risk areas.

Contribution to Academic Knowledge

This study fills critical gaps in the existing literature regarding maternal nutrition, particularly in low- and middle-income countries. By focusing on a specific population, it will provide a baseline for future research on maternal malnutrition and its determinants. The results can be compared with studies from other regions, contributing to a broader understanding of maternal nutrition globally. This academic contribution will enhance the body of knowledge necessary for developing effective interventions and inform future research directions in public health and nutrition.

2. Literature Review

2.1 Theoretical Reviews

2.1.1. Definition of basic terms and concepts

Malnutrition refers to a condition that arises from an inadequate or unbalanced intake of nutrients, leading to various health issues. It refers to the condition where an individual's diet does not provide adequate nutrients for optimal health and development. It can manifest as undernutrition (e.g., stunting, wasting, and underweight) or overnutrition (e.g., overweight and obesity). Malnutrition can impair physical and mental development, particularly in children and pregnant women, and contribute to various health problems (32).

Undernutrition typically refers to insufficient caloric and protein intake, impacting a mother's ability to meet the physiological demands of pregnancy, including increased blood volume, placenta development, and fetal growth. This type of malnutrition results in low maternal body mass index (BMI) and insufficient weight gain, leading to higher risks of fetal growth restriction and complications such as small-for-gestational-age (SGA) births (39).

Overnutrition refers to excessive intake of nutrients, leading to overweight, obesity, and other diet-related non-communicable diseases (NCDs). It is characterized by an energy imbalance where food intake exceeds the body's energy needs (40).

Underweight is defined by a Body Mass Index (BMI) less than 18.5 kg/m² and often indicates insufficient nutrition, inadequate caloric intake, or underlying health issues. It can lead to impaired immune function, increased susceptibility to infections, and complications during pregnancy and **Overweight** is defined by a BMI between 25 and 29.9 kg/m² and is often associated with an increased risk of chronic diseases like hypertension, diabetes, and cardiovascular problems (41,42).

Stunting refers to low height-for-age, indicating chronic malnutrition during early childhood. It reflects inadequate nutrition over a long period and is a strong indicator of poor growth and development, often leading to cognitive impairments and long-term health issues and **Wasting** refers to low weight-for-height, which is a sign of acute malnutrition. It is characterized by rapid weight loss or failure to gain weight, often due to insufficient food intake or illness. Wasting is a major cause of mortality in young children (43,44).

Micronutrient deficiencies are prevalent in low-income settings, where pregnant women may lack access to a varied diet. **Iron deficiency** is particularly common and can lead to anemia, a condition associated with preterm

birth, low birth weight, and maternal mortality (45). Other essential nutrients include **folate** for neural tube development; **iodine** for fetal brain development; **calcium** and **vitamin D** for bone formation and fetal skeletal development (46). These deficiencies contribute to poor pregnancy outcomes and increase the risk of long-term developmental issues for the child, emphasizing the importance of adequate nutrition during pregnancy.

Prenatal care refers to the medical care provided to women during pregnancy to monitor and maintain maternal and fetal health. It includes regular check-ups, screenings, nutritional guidance, and counseling to reduce risks during pregnancy and improve outcomes for both mother and child (47).

Maternal and child health outcomes refer to the health results for women during pregnancy, childbirth, and the postnatal period, as well as for children from birth to early childhood. These outcomes are influenced by factors such as nutrition, healthcare access, and socio-economic conditions and have long-term implications for both the mother and child (48).

2.1.2. Clinical Conditions of Malnourished Women

Causes of Malnutrition: Malnutrition in women can arise from a variety of factors, including inadequate dietary intake, Poor access to food, lack of knowledge about nutrition, restrictive diets, and food insecurity can lead to insufficient nutrient consumption. **Increased nutritional needs** Events such as pregnancy, lactation, and rapid growth in adolescence increase the nutritional requirements for women, making them more vulnerable to malnutrition if these needs are not met (49). **Chronic illnesses** Conditions such as diabetes, gastrointestinal disorders, and cancer can interfere with nutrient absorption and increase metabolic demands, leading to malnutrition (50). **Socioeconomic factors** Poverty, education level, and cultural beliefs influence dietary choices and access to food, contributing to malnutrition (51). **Psychosocial issues** Factors such as depression, anxiety, and eating disorders can affect food intake and nutritional status (52).

Severity Conditions of Malnutrition: Malnutrition can be classified into different severity levels based on nutritional status and clinical presentation:

Mild Malnutrition (Low Severity): Characterized by slight unintentional weight loss or a body mass index (BMI) below the optimal range but not critically low. Women may experience some fatigue or weakness but might still be able to engage in daily activities.

Moderate Malnutrition: Identified by more pronounced weight loss (5-10% of body weight), a BMI in the lower range, and increased fatigue. Women may have compromised immune function and an increased risk of infection.

Severe/Chronic Malnutrition: This includes significant weight loss (more than 10% of body weight), a severely low BMI ($<16 \text{ kg/m}^2$), or the presence of edema. Women display severe fatigue, muscle wasting, and may have clinical signs of anemia or other deficiencies. This level of malnutrition can lead to long-term health complications and increased mortality risk (53).

Signs of Malnourished Women: The clinical signs of malnutrition in women can include:

Weight Loss, Unintentional weight loss over a short period, which may be evident through clothing fit or body measurements. **Muscle Wasting,** Visible loss of muscle mass, which may be assessed through physical examination or anthropometric measurements. **Fatigue and Weakness** such as generalized weakness, decreased energy levels, and fatigue that impair daily activities. **Skin and hair Changes** like Dry, flaky skin, and hair thinning or loss, which may indicate deficiencies in essential fatty acids, vitamins, and minerals.

Dental Issues such as Poor oral health, including gum disease and tooth decay, can be associated with malnutrition due to lack of certain vitamins and minerals (54). **Gastrointestinal Symptoms** such as bloating, diarrhea, or constipation may occur due to inadequate dietary fiber or resultant from malabsorption issues. **Impaired Immune Function,** Increased susceptibility to infections, prolonged recovery from illnesses, and frequent illnesses may be linked to malnutrition.

2.1.3. Consequences of Malnutrition on Maternal and Fetal Health

Malnutrition during pregnancy is linked to an array of adverse health outcomes for both mother and child. Studies indicate that **maternal malnutrition** directly contributes to an increased risk of obstetric complications, including anemia, gestational hypertension, preeclampsia, and gestational diabetes (55). For instance, anemia due to iron deficiency increases the likelihood of postpartum hemorrhage and reduces a mother's immunity, making her more susceptible to infections. Gestational hypertension and preeclampsia, both linked to malnutrition, pose serious risks to maternal health, potentially leading to eclampsia if untreated, which endangers both mother and child (56). The fetal impacts of maternal malnutrition are equally severe. Inadequate nutrient intake by the mother restricts fetal growth, often resulting in low birth weight (LBW), a critical determinant of infant mortality and morbidity.

LBW infants are at higher risk for respiratory distress, infections, and developmental delays (57). Research also links maternal malnutrition with preterm births, which carry heightened risks for neonatal complications, including intraventricular hemorrhage and long-term health issues like cognitive delays and metabolic syndromes later in life (58). Additionally, maternal malnutrition disrupts fetal programming, potentially leading

to adult-onset diseases such as hypertension, diabetes, and cardiovascular diseases through a process known as **fetal programming** or **developmental origins of health and disease** (DOHaD) (59).

2.1.4. Factors Influencing Nutritional Status in Pregnancy

Numerous factors influence nutritional status among pregnant women, many of which are interrelated and often reflect socio-economic conditions. **Socio-economic status (SES)** is one of the most significant determinants, as women with lower SES often experience food insecurity and have limited access to nutrient-rich foods. Economic constraints hinder their ability to afford diverse diets, contributing to nutritional deficiencies (60). Lower educational levels, a common correlate of lower SES, can also affect nutritional knowledge, leading to inadequate dietary practices during pregnancy (61).

Cultural practices and beliefs surrounding food and pregnancy can also impact nutritional intake. In some cultures, taboos restrict certain foods during pregnancy, which may prevent women from consuming adequate protein, iron, or calcium. This is often coupled with **low healthcare access**, especially in rural areas, where pregnant women may not receive regular antenatal care or nutritional counseling, increasing the risk of malnutrition (62). Additionally, **psychosocial factors**, such as stress and mental health, have been shown to influence maternal nutrition, with high-stress levels associated with poor dietary habits and nutrient deficiencies (63).

Environmental factors, particularly **food security** and **seasonal variations**, also play a role in influencing dietary intake. In agricultural regions, access to food may fluctuate with seasons, affecting the availability of fruits, vegetables, and protein-rich foods during certain months (64). For instance, studies in Ethiopia have shown that pregnant women are more likely to experience undernutrition during pre-harvest seasons when food stocks are low, and prices are higher (65).

Seasonal food shortages underscore the need for year-round dietary support, particularly for vulnerable groups such as pregnant women. **Maternal knowledge and awareness** of nutrition and self-care practices play a vital role in pregnancy outcomes. Women who understand the importance of nutrient-rich diets are more likely to seek nutritional supplements and make dietary adjustments during pregnancy. However, the knowledge gap remains significant in many low-resource settings, and promoting nutrition education through healthcare providers is essential for improving maternal health outcomes (66).

2.2. Empirical Literature Review

2.2.1. Prevalence of Maternal Malnutrition in Low- and Middle-Income Countries (LMICs)

Maternal malnutrition remains a significant public health issue in low- and middle-income countries (LMICs), contributing to adverse pregnancy outcomes and long-term health consequences for both mothers and children. A study in India found that approximately 21% of pregnant women were underweight, with regional variations, particularly in rural areas where access to healthcare and nutritious food is limited (67). In Bangladesh, a study revealed that 24% of pregnant women were undernourished, with malnutrition being significantly associated with lower socioeconomic status and poor dietary diversity (68). Similarly, a study conducted in Nepal showed that 28% of pregnant women experienced chronic energy deficiency, and the prevalence of micronutrient deficiencies, such as iron and vitamin A, was also notably high (69).

In sub-Saharan Africa, maternal malnutrition is prevalent due to factors such as food insecurity, poverty, and limited access to quality maternal healthcare. A study in Nigeria found that 18% of pregnant women were underweight, and about 26% had anemia, which is a direct consequence of poor nutrition (70). In Kenya, a study reported that 22% of pregnant women had a BMI below the normal range, with maternal malnutrition linked to both underweight and micronutrient deficiencies such as folate and iron (71). In Latin America, the prevalence of maternal malnutrition is also concerning. A study in Guatemala showed that 23% of pregnant women were classified as undernourished, and a significant portion also had micronutrient deficiencies, particularly iron and iodine, which are critical for maternal and fetal health (72). Similarly, in Bolivia, approximately 19% of pregnant women were found to be underweight, with socioeconomic disparities influencing the nutritional status of pregnant women (73).

2.2.2. Prevalence of Malnutrition among Pregnant Women in Ethiopia

Malnutrition among pregnant women is a significant public health concern in Ethiopia, where undernutrition and micronutrient deficiencies contribute to maternal and child health risks. Studies indicate that malnutrition in Ethiopia remains widespread, especially in rural and low-resource settings, where food insecurity and inadequate healthcare services persist (13). A recent national survey found that approximately 22% of Ethiopian women of reproductive age are underweight, with an even higher prevalence in regions with limited healthcare access (74).

A study in the Amhara region, which neighbors Tigray, reported a malnutrition prevalence of about 26% among pregnant women and found that maternal malnutrition was significantly associated with low income, poor dietary intake, and inadequate prenatal care (75).

In East Borena Zone A 2021 study reported that 44.9% of pregnant women were undernourished. Factors such as food insecurity, low dietary diversity, and lack of antenatal care utilization were significantly associated with maternal malnutrition (76). In Bench-Sheko and Kaffa Zones Research conducted in public hospitals revealed that 42.4% of pregnant women suffered from undernutrition. Key determinants included low educational status, household food insecurity, and poor nutrition awareness (77).

In rural settings, a study found that 43.8% of pregnant women were undernourished. Contributing factors were limited access to health services, poor dietary practices, and socioeconomic challenges (19). In North Gondar A community-based study in conflict-affected areas documented that 34.3% of pregnant women were undernourished. Key contributors included armed conflict, food insecurity, and lack of healthcare access (78).

Research in Alamata found that 22.3% of pregnant women were undernourished, with determinants such as food insecurity, poor dietary practices, and inadequate antenatal care follow-up (79). A study conducted in the Tigray region found that malnutrition, as measured by body mass index (BMI) and mid-upper arm circumference (MUAC), was prevalent among pregnant women attending antenatal care, with approximately 30% of women classified as undernourished (80). The study highlighted the role of food insecurity and low dietary diversity as significant contributors to maternal malnutrition. Similarly, In Tigray Region A study in a public general hospital in Tigray reported an undernutrition prevalence of 40.6%. Significant factors included food insecurity, low hemoglobin levels, and substance use during pregnancy (81).

2.2.3. Factors Associated with Malnutrition among Pregnant Women

Malnutrition among pregnant women is a significant public health concern that can adversely affect maternal and fetal health outcomes. Various factors contribute to malnutrition during pregnancy, particularly in low- and middle-income countries (LMICs). **Low socioeconomic status** is closely associated with malnutrition in pregnant women. Women from poorer households often experience food insecurity, which may limit their access to nutritious foods. Economic constraints can lead to diets that lack essential vitamins and minerals (82). Research in India found that low-income women had a higher prevalence of undernutrition and anemia during pregnancy due to inadequate dietary intake (83). **Inadequate dietary intake** is prevalent among pregnant women in many LMICs. Cultural practices, food preferences, and dietary restrictions can lead to insufficient consumption of essential nutrients such as folic acid, iron, and protein. A study conducted in Nigeria showed

that pregnant women with limited dietary diversity were more likely to experience malnutrition (84). **Pregnant women with pre-existing health conditions**, such as obesity or diabetes, are at increased risk of experiencing malnutrition. These conditions can complicate pregnancy and affect nutrient absorption. A systematic review indicated that pre-existing conditions significantly contribute to adverse pregnancy outcomes in LMICs (85).

Adolescent mothers and women with multiple pregnancies (high parity) are particularly vulnerable to malnutrition. Younger mothers often have increased nutritional needs that may not be met, while multiparous women may experience depletion of their nutritional reserves. An analysis in Bangladesh revealed that adolescents had higher rates of anemia compared to older pregnant women, emphasizing the need for targeted interventions (86). **Limited access to healthcare and prenatal services** is a major factor contributing to malnutrition among pregnant women. Effective prenatal care is crucial for monitoring nutritional status and providing necessary supplements. In Kenya, a study found that women with inadequate access to prenatal care had poorer nutritional outcomes and higher rates of complications during pregnancy (87).

Frequent infections and illnesses can increase nutritional demands and contribute to malnutrition. Common issues, such as malaria and gastrointestinal infections prevalent in LMICs, can impact nutrient absorption and overall health. Research from Tanzania highlighted that women who experienced frequent illnesses during pregnancy had a higher risk of undernutrition (88). **Maternal mental health** significantly impacts nutrition during pregnancy. Conditions such as depression and anxiety can lead to poor dietary choices and inadequate nutritional intake. A study in South Africa found that women with mental health challenges were more likely to report insufficient food intake and higher rates of undernutrition (89).

2.2.4. Gaps in Research and Implications for Mekelle

While there are numerous studies on malnutrition among pregnant women in Ethiopia, there is limited research specifically addressing urban and semi-urban areas like Mekelle and there are gaps in the existing literature on the prevalence of malnutrition and its associated factors among pregnant women in Ethiopia, particularly in conflict-affected regions like Tigray. Most studies focus on rural populations, which may have different socioeconomic and healthcare access challenges. Additionally, few studies have examined the seasonal variations in food security and dietary intake in Mekelle, which could provide insights into the unique nutritional challenges faced by pregnant women in the region. Addressing these research gaps could enhance the understanding of malnutrition dynamics in northern Ethiopia and support the development of targeted interventions.

2.3. Conceptual framework

The conceptual framework visually presents the relationship between various factors (independent variables) and malnutrition status (dependent variable) among pregnant women. Below, will detail the framework structure and include definitions with references for each variable.

Visual Structure of the Framework

Below is a schematic representation for the conceptual framework. Each independent variable type is connected by arrows pointing toward the dependent variable, showing their hypothesized influence on malnutrition among pregnant women:

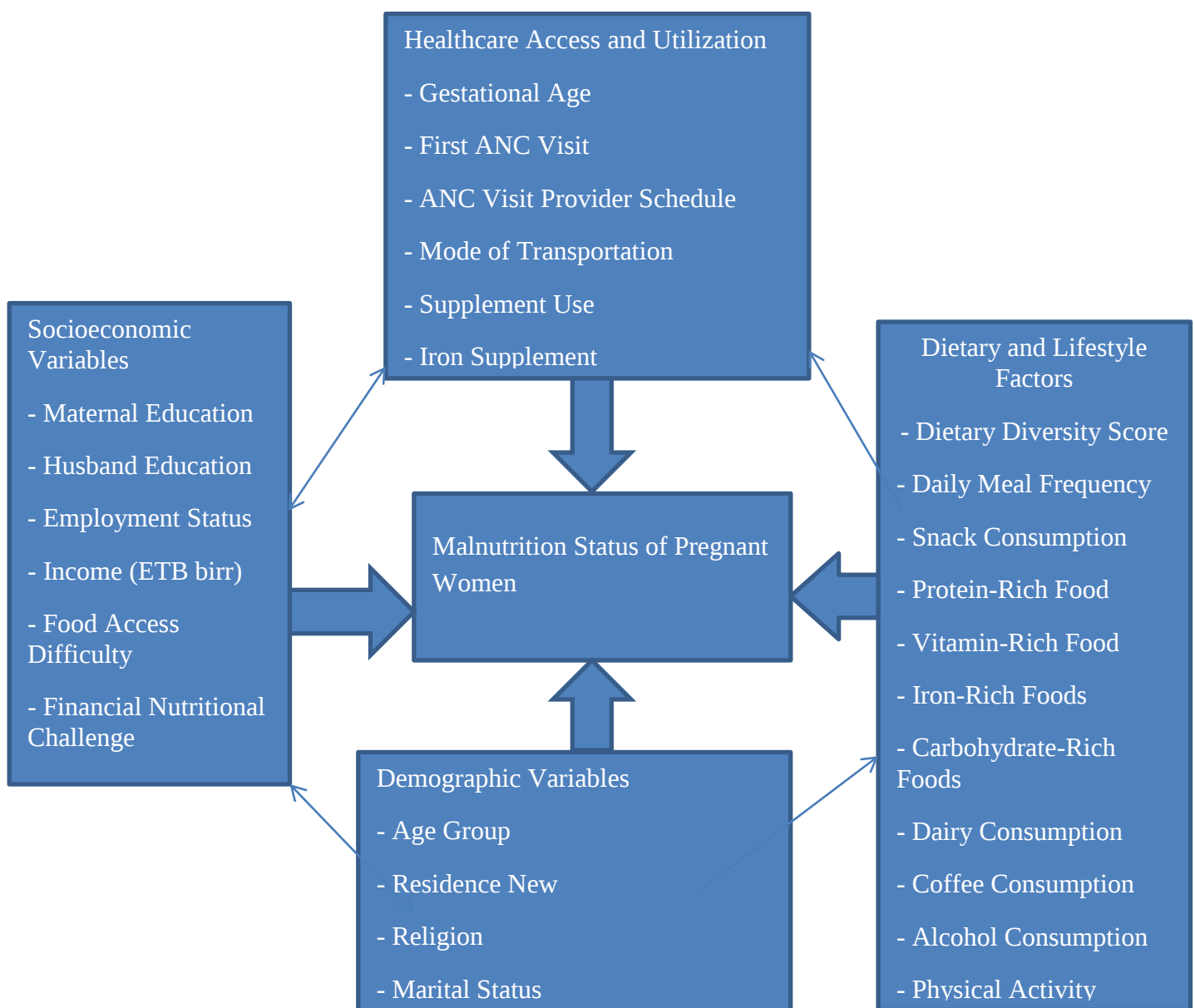


Figure 1: Visual Structure of the Framework

2.3.1. Socioeconomic Factors, Demographic Factors, Dietary and Lifestyle Factors, Healthcare Access and Utilization

Income Level: The economic status of pregnant women affects access to nutritious foods, healthcare, and overall quality of life. Lower income levels are associated with higher risks of malnutrition due to food insecurity and lack of dietary diversity (90).

Education Level: Education can influence health knowledge, dietary choices, and access to healthcare. Higher education is generally linked to better nutritional outcomes (91).

Employment Status: Employment status influences income, social standing, and stress levels, all of which can indirectly affect nutritional intake and malnutrition risk (92).

Dietary Diversity: A varied diet is essential for obtaining the necessary macro- and micronutrients during pregnancy. Limited dietary diversity is often linked to malnutrition (92).

Food Intake Frequency: Regular meals help maintain energy levels and nutrient availability. Irregular or infrequent meals can contribute to inadequate nutrient intake (93).

Physical Activity Level: Adequate physical activity supports healthy pregnancy weight and reduces the risk of complications, while a sedentary lifestyle may contribute to malnutrition and poor health outcomes (94).

Age of the Pregnant Woman: Younger or older maternal age can increase nutritional risk, as nutritional requirements and physiological stress vary across age groups (95).

Parity (Number of Previous Pregnancies): Higher parity is associated with increased nutrient needs, potentially increasing malnutrition risk in subsequent pregnancies (96).

Marital Status: Marital support can impact financial stability and social support, affecting nutrition during pregnancy (97).

3. Objectives

3.1 General Objective

To assess the prevalence of malnutrition and Identify the associated factors among pregnant women attending prenatal care at Mekelle General Hospital in 2025.

3.2. Specific Objectives

1. To determine the Prevalence of Malnutrition among pregnant women.
2. To Assess Dietary Practices of pregnant women in the study area.
3. To examine Socio-Demographic Factors associated with the nutritional status of pregnant women.

3.3. Research Question

1. What is the prevalence of malnutrition among pregnant women attending prenatal care at Mekelle General Hospital?
2. What is the effect of dietary intake on the nutritional status of pregnant women at Mekelle General Hospital?
3. What socio-demographic factors are associated with malnutrition among these pregnant women?

4. Methods

4.1. Study Area

The study was conducted at Mekelle General Hospital (MGH), located in Mekelle, Northern Ethiopia. Mekelle, the capital city of the Tigray Administrative Regional State, is situated 783 km from Addis Ababa. The hospital, which was established in 1962, was continued to serve more than 500,000 people from various regions.

As of 2017, Mekelle had a population of 412,938, with 23.5% of residents being females of reproductive age (15–49 years). Within this demographic, it is estimated that there are around 12,333 pregnant mothers residing in the town. Mekelle is recognized as one of Ethiopia's metropolitan areas and is divided into seven sub-administrative units. The healthcare infrastructure in Mekelle includes one teaching referral hospital, seven general hospitals, and nine health centers, complemented by 48 privately owned clinics.

4.2. Study Design

Institution based quantitative cross-sectional study was employed to assess Malnutrition and associated factors among pregnant women attending prenatal care in Mekelle General Hospital, Tigray, Northern Ethiopia, 2025.

4.3. Study Population

In this study, the source population consists of **all pregnant women living in Mekelle city and its surrounding areas** who may access healthcare services at Mekelle General Hospital. This population includes all pregnant women who are part of the hospital's catchment area, regardless of whether they are actively receiving prenatal care or planning to attend prenatal care at Mekelle General Hospital.

In this case, the target population includes **all pregnant women attending prenatal care at Mekelle General Hospital**. This group represents the pregnant women who seek medical care specifically at this hospital and may face challenges in nutritional health that the study aims to assess.

The study population includes **all pregnant women who attend prenatal care at Mekelle General Hospital** during the data collection period and who meet specific inclusion and exclusion criteria. These criteria were used to help refine the study sample to ensure that the data collected accurately represents the nutritional status and associated factors of interest.

The study unit is **each individual pregnant woman attending prenatal care** at Mekelle General Hospital. Each pregnant woman provided data through direct measurement (e.g., BMI, MUAC) and self-reporting (e.g., dietary, lifestyle, and socioeconomic factors).

4.4. Inclusion Criteria and Exclusion Criteria

Inclusion Criteria: Age 18-49 pregnant women attending prenatal care at Mekelle General Hospital during the study period.

Exclusion Criteria: Women with chronic illnesses or conditions affecting nutrition (e.g., diabetes, renal disease) or those who are critically ill and those who do not permanently resident in the study area were excluded from the study.

4.5. Sampling technique and Sample Size Calculation

A simple random sampling method was utilized. A comprehensive sampling frame was created, listing all pregnant women attending prenatal care at the hospital. Participants were randomly selected using a random number generator until the target sample size was reached.

Sample size was calculated using single population proportion formula: $n = Z^2 \cdot p \cdot (1-p) / d^2$

Where:

n = sample size,

Z = Z-score for a 95% confidence level (1.96),

p = estimated prevalence of malnutrition (40.6% or 0.406),

d = margin of error (5% or 0.05).

By assuming margin of error (d) = 5%, confidence level 95% and proportion of undernutrition (P) =40.6%. By considering a 10% nonresponse rate, it becomes 408.

4.6. Data Collection Procedures

A structured questionnaire was initially prepared in English and then translated into the local language, Tigrigna in this context, which was finally used to administer the questionnaire. The Tigrigna version was again be translated back to English to check for any inconsistencies or distortion in the meaning of words. Data was collected using an interviewer-administered MUAC and BMI measurement questionnaire was adapted from the literature. Data collection was performed by two B.Sc. nurses. To assure the quality of the data, a properly designed data collection instrument and training of data collectors and supervisors was conducted. The enumerators and the supervisor received training for three days on procedures, techniques, ways of collecting

the data, and monitoring the procedure. A ten percent pretest was done at the 11 Lekatit Primary hospital to check the consistency of the questionnaire. The collected data was reviewed and checked for completeness by supervisors and principal investigators each week. MUAC was measured by considering the mothers in a Frankfurt plane and sideways to measure the left side, with arms hanging loosely at the side and palms facing inward. Measurements were taken at the marked midpoint of the upper left arm using a flexible non-stretchable tape, and the difference between trainee and trainer was maintained at 0–5 mm.

4.7. Variables

Dependent Variable: In this study, the dependent variable was Malnutrition among pregnant women attending prenatal care. Was defined mid-upper arm circumference values below a cutoff point <23 cm were considered as undernutrition in this study, whereas for the individual in the third-trimester (23 cm and above), it was considered normal.

Independent Variables: Independent variables were all the Socioeconomic Factors, Dietary and Lifestyle Factors, Demographic Factors, Healthcare Access and Utilization.

4.8. Operational Definitions

Malnutrition: in this study refers to a state of nutritional imbalance that can manifest as undernutrition, overnutrition, or micronutrient deficiencies. For the purpose of this research, malnutrition will be specifically defined and measured using the following indicators:

Underweight: This will be assessed using the Body Mass Index (BMI), which is calculated as

$$BMI = \frac{Wgt}{Hgt^2}$$

Where: BMI: Body Mass Index (kg/m²) , Wgt: Weight of the pregnant women in kilograms (kg) and Hgt: heights of the pregnant women in meters (m).

Weight in kilograms divided by height in meters squared (kg/m²). Pregnant women with a BMI of less than 18.5 kg/m² are classified as underweight, indicating potential undernutrition (98)

Anemia: Anemia is defined according to the World Health Organization (WHO) criteria, whereby pregnant women are considered anemic if their hemoglobin level is less than 11 g/dL (99). Hemoglobin levels will be measured using a portable hemoglobinometer or through laboratory analysis of blood samples.

Mid-Upper Arm Circumference (MUAC): MUAC is measured using a non-stretchable measuring tape at the midpoint between the acromion and the olecranon process of the arm. A MUAC measurement of less than 23 cm will indicate malnutrition among pregnant women (100).

Micronutrient Deficiencies: Specific micronutrient deficiencies, such as iron and folate, are assessed through blood tests that measure serum ferritin and serum folate levels, respectively. Deficiencies are defined as serum ferritin levels below 15 µg/L for iron deficiency (101) and serum folate levels below 3 ng/mL for folate deficiency (102).

4.9. Data Analysis Procedures

Data entry was performed by two independent researchers to minimize errors. A regular audit of data collection forms was conducted to ensure adherence to protocols. Missing data were addressed using appropriate statistical methods, and the data were analyzed using STATA statistical software.

To determine the prevalence of malnutrition among pregnant women, descriptive statistics were utilized. This included calculating the frequency and percentage of women classified as malnourished based on defined indicators such as underweight, anemia, low MUAC, and micronutrient deficiencies.

Calculation of Prevalence Rates: The prevalence of each type of malnutrition was calculated as follows:

Prevalence = (Number of cases of malnutrition / Total number of pregnant women surveyed) × 100

Identifying Factors Affecting Malnutrition: To identify the factors associated with malnutrition among pregnant women, binary logistic regression analysis was employed. This technique is appropriate for analyzing binary outcomes (e.g., presence or absence of malnutrition). The model included independent variables such as socio-demographic factors (age, education level, income), health-related factors (previous pregnancies, chronic diseases), Health care access and dietary practices.

The odds ratios (OR) and their 95% confidence intervals (CIs) were calculated to determine the strength and significance of associations between potential risk factors and malnutrition. A p-value of less than 0.05 was considered statistically significant.

Examining Dietary Practices: Using descriptive statistics such as mean, standard deviation, and frequency distributions, we calculated values for variables related to food consumption patterns, dietary diversity scores, and nutrient intake among pregnant women.

A Dietary Diversity Score (DDS) was computed based on the number of different food groups consumed over a specified period (e.g., 24 hours). The mean DDS was provide insights into the overall dietary habits of the participants.

The logistic regression model for predicting malnutrition status can be expressed as:

$$\log((p / 1-p)) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_k X_k$$

Where:

p = Probability of being malnourished (malnutrition = 1)

β_0 = Intercept

$\beta_1, \beta_2, \dots, \beta_k$ = Coefficients for each predictor variable

$X_1, X_2, \dots, X_k$ = Independent variables (socio-demographic factors, dietary habits, socioeconomic factors)

This can be further specified as:

$$\log((p / 1-p)) = \beta_0 + \beta_1 (\text{Socioeconomic Factors}) + \beta_2 (\text{Dietary and Lifestyle Factors}) + \beta_3 (\text{Demographic Factors}) + \epsilon$$

Socioeconomic Factors: Includes variables such as income level, education level, and employment status.

Dietary and Lifestyle Factors: Includes variables such as dietary diversity, meal frequency, physical activity, and substance use.

Demographic Factors: Includes variables such as age, parity, and marital status.

Healthcare Access and Utilization: includes variables such as number of ANC visit, distance to health care facility etc.

ϵ = Error term, accounting for random variability.

4.10. Ethical Considerations

Ethical approval was sought from ethical review committee. After approval of ethical issues, permissions were obtained from both the Tigray Health Bureau and the authorities of the hospitals to undertake the study. Informed consent was obtained from all participants prior to data collection. Participants were informed about the study's purpose, procedures, risks, and benefits. Confidentiality was maintained by anonymously and securely storing it in password-protected files. Participants had the right to withdraw from the study at any time without any consequences.

4.11. Dissemination of Results

Submit articles to peer-reviewed journals related to nutrition, public health, or maternal and child health. Present findings at national and international conferences to engage with other researchers and practitioners and organize workshops or seminars for local health workers, community leaders, and stakeholders to share findings and discuss implications.

5. Result

5.1. Socioeconomic and Demographic Characteristics of Pregnant Women

A total of 408 pregnant women were included in the study. The age distribution showed 259 (63.5%) aged 18–29 years, 141 (34.6%) aged 30–39 years, and 8 (1.96%) aged 40–59 years. Most women, 383 (93.9%), resided in urban areas, and 401 (98.3%) were Orthodox Christian. Regarding education, 151 (37.0%) had secondary education, and 126 (30.9%) had higher education. Marital status indicated 366 (89.7%) were married, and 164 (40.2%) of their husbands had higher education. Employment status revealed 241 (59.0%) were unemployed, 93 (22.8%) employed, and 74 (18.2%) self-employed. The majority Monthly household income was 160 (39.2%) for 5,000–10,000 ETB. Regarding food access, 377(92.4%) of participants had access to food, however, the 31 (7.6%) who reported limited access may face nutritional difficulties. Finance was identified 212 (52.0%) as a challenge affecting nutrition (**Table 1**).

Table 1: Socioeconomic and Demographic Characteristics Among Pregnant Women Attending Prenatal Care at Mekelle General Hospital in 2025 (n=408).

Variables	Categories	Frequency	Percent
Age group	18-29	259	63.5
	30-39	141	34.6
	40-59	8	1.96
Residence	Urban	383	93.9
	Rural	25	6.13
Religion	Orthodox	401	98.3
	Muslim	7	1.72
Maternal education	No formal education	28	6.9
	Primary	103	25.2
	Secondary	151	37.0
	Higher	126	30.9
Marital Status	Single	30	7.3
	Married	366	89.7
	Divorced	10	2.5
	Widowed	2	0.5
Husband education	No formal education	37	9.0
	Primary	60	14.8

	Secondary	147	36.0
	Higher	164	40.2
Employment Status	Employed	93	22.8
	Self employed	74	18.2
	Unemployed	241	59.0
Income(ETB birr)	<5,000	156	38.2
	5,000-10,000	160	39.2
	10,001-20,000	67	16.4
	>20,000	25	6.1
Food access Difficulty	Yes	31	7.6
	No	377	92.4
Financial nutritional challenge	Yes	212	52.0
	No	196	48.0

5.2. Reproductive Health Characteristics and Healthcare Access

The parity distribution indicated that 138 (33.8%) women had their first pregnancy, 184 (45.1%) had 1–2 prior pregnancies, and 86 (21.1%) had 3 or more. In terms of gestational age, 150 (37.8%) women were in the later stages of pregnancy (>24 weeks), while 135 (33.1%) were in the second trimester (12–24 weeks), 66 (16.2%) were at 24 weeks, and 57 (14.0%) were at <12 weeks. The fact that 247 (60.5%) women had scheduled ANC visits suggests regular monitoring could enhance nutritional intake and reduce malnutrition risk. A considerable portion, 139 (34.1%), relied on walking as their mode of transportation, with 261 (63.9%) using public transport and 8 (1.9%) using other modes. A larger majority 194 (47.5%) gained health-related information from professionals. Nutritional counseling was received by 204 (50.0%) participants. Additionally, the mean number of prenatal care visits was 3.24 (SD 2.08) and the mean distance to healthcare facilities was 5.10 km (SD 6.11) (Table 2).

Table 2: Reproductive Health Characteristics and Healthcare access among Pregnant Women Attending Prenatal Care at Mekelle General Hospital in 2025 (n=408).

Variables	Category	Frequency	Percent
Parity	First	138	33.8
	1-2	184	45.1
	3 or more	86	21.1

Gestational Age	<12 weeks	57	14.0
	12-24 weeks	135	33.1
	24 weeks	66	16.2
	Above 24 weeks	150	37.8
First ANC Visit	First trimester	227	55.6
	Second trimester	173	42.4
	Third trimester	8	1.9
ANC visit provider schedule	Yes	247	60.5
	No	161	39.5
Mode of transportation	Public transport	261	63.9
	Walking	139	34.1
	Other	8	1.9
Dietary information (Healthcare)	Yes	194	47.5
	No	214	52.5
Dietary information (family/friends)	Yes	63	15.4
	No	345	84.6
Dietary information (Media)	Yes	54	13.2
	No	354	86.8
Nutritional counseling	Yes	204	50.0
	No	204	50.0

5.3. Dietary Practices, Supplement Use and Lifestyle Factors

Among the 408 participants, regarding dietary diversity, most participants, 378 (92.7%), consumed 1-2 food groups, and 30 (7.3%) consumed 3-4 groups. the majority, 309 (75.7%), consumed three meals daily, while a small proportion, 5 (1.2%), reported eating only once a day. In terms of snack consumption, 105 (27.7%) reported daily intake, with data for other frequencies (often, rarely, never). Among food groups, the majority, 338 (82.8%), consumed vitamin-rich foods daily, while 285 (69.8%) rarely consumed iron-rich foods, and 209 (51.2%) rarely consumed dairy. A substantial proportion, 184 (45.1%), used supplements regularly, with an additional 85 (20.8%) using them occasionally, and 139 (39.0%) not using them. Furthermore, a high proportion, 247 (92.2%), used iron supplements, followed by 9 (3.4%) using Folic acid and 20 (7.5%) using multivitamins supplements. Finally the lifestyle factors, 276 (67.6%) reported coffee consumption, 111 (27.2%) consumed alcohol, and 121 (29.7%) engaged in physical activity (**Table 3**).

Table 3: Dietary Practices, Supplement Use and Lifestyle Factors Among Pregnant Women Attending Prenatal Care at Mekelle General Hospital in 2025 (n=408).

Variables	Category	Frequency	Percent
Dietary diversity Score	1-2	378	92.7
	3-4	30	7.3
Daily meal frequency	One	5	1.2
	Two	50	12.2
	Three	309	75.7
	4 >= Four	44	10.8
Snack consumption	Daily	105	27.7
	Often	20	4.9
	Rarely	182	44.6
	Never	101	24.7
Protein- Rich food	Daily	12	2.9
	Rarely	238	58.3
	Not	158	38.7
Vitamin –Rich food	Daily	62	15.2
	Rarely	338	82.8
	Not	8	1.9
Iron rich foods	Daily	8	1.9
	Rarely	285	69.8
	Not	115	28.2
Carbohydrate-Rich foods	Daily	203	49.8
	Rarely	199	48.7
	Not	6	1.5
Dairy Consumption	Daily	36	8.8
	Rarely	163	40.0
	Not	209	51.2
Supplement use	Yes occasionally	85	20.8
	Regularly	184	45.1
	No	139	39.0

Iron Supplement	Yes	247	92.2
	No	21	7.8
Folic acid supplement	Yes	9	3.4
	No	259	96.6
Multivitamins	Yes	20	7.5
	No	248	92.5
Coffee consumption	Yes	276	67.6
	No	132	32.4
Alcohol consumption	Yes	111	27.2
	No	297	72.8
Physical activity	Yes	121	29.7
	No	287	70.3

5.4. Anthropometric Measurements

Among 408 pregnant women attending prenatal care at Mekelle General Hospital in 2025, 41.2% (168 women) had a Mid-Upper Arm Circumference (MUAC) below 23 cm, indicating a high prevalence of malnutrition, while 58.8% (240 women) had adequate MUAC (≥ 23 cm). In contrast, only 13.5% (55 women) were underweight (BMI < 18.5), with 86.5% (353 women) having a BMI ≥ 18.5 (**Table 4**).

Table 4: Anthropometric Measurements among Pregnant Women Attending Prenatal Care at Mekelle General Hospital in 2025 (n=408)

Variables	Category	Frequency	Percent
MUAC < 23 cm	< 23 cm	168	41.2
	>23 cm	240	58.8
BMI < 18.5	<18.5	55	13.5
	>18.5	353	86.5

5.5. Prevalence and Socio-Demographic Correlates of Malnutrition

The prevalence of malnutrition among pregnant women in mekelle general hospital was 41.2 % (95%CI: 36.4, 46.0) based on MUAC and 13.5 % (95% CI: 1.40–4.39%) based on BMI measurements, with MUAC being the primary metric reported.

As the graph showed, among the 408 participants, a larger majority, 259 (63.48%), were aged 18–29 years, and 383 (93.87%) resided in urban areas. The MUAC revealed concerning results: 168 (41.2%) were classified as malnourished (MUAC < 23 cm), while 240 (58.8%) had normal nutritional status (MUAC ≥ 23 cm). Stratified by age group, the 18–29 years group showed the highest malnutrition prevalence, with 111 (42.86%) malnourished, followed by 30–39 years at 56 (39.72%) and 40–59 years at 1 (12.50%). By residence, a larger majority of rural participants were malnourished, with 17 (68.00%) affected, compared to 151 (39.43%) in urban areas. When combining age and residence, rural participants aged 30–39 exhibited the highest malnutrition prevalence, with an estimated 7 (77.8%) malnourished, followed by 18–29 rural at 10 (66.7%) and 18–29 urban at 101 (41.4%). The 40–59 age groups, particularly in rural areas, had limited representation, reducing prevalence reliability (Figure 2).

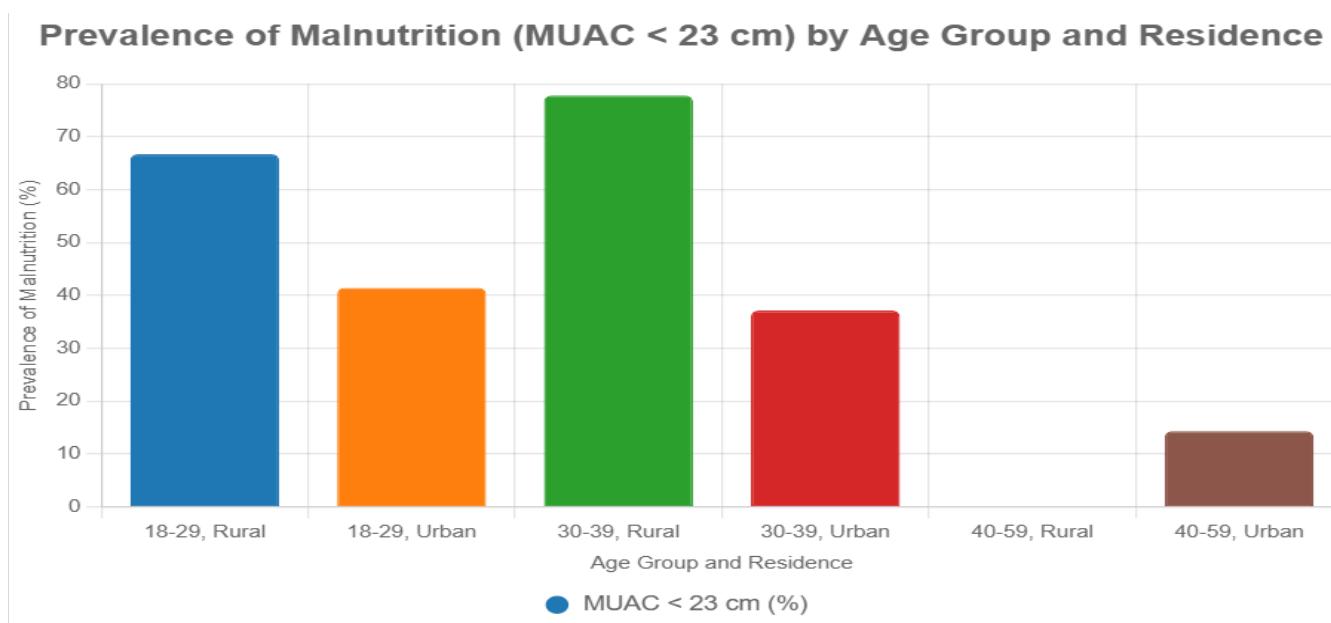


Figure 2: Prevalence and Socio-Demographic Correlates of Malnutrition among Pregnant Women Attending prenatal Care at Mekelle General Hospital, 2025 (n=408).

5.6. Determinants of nutritional status among pregnant women attending prenatal care at Mekelle General Hospital

A logistic regression model ($n=408$) was used to identify factors associated with malnutrition ($MUAC < 23$ cm) among pregnant women attending prenatal care at Mekelle General Hospital. The model was statistically significant ($LR\ chi^2(12)=40.64$, $p<0.001$, $Pseudo R^2=0.0735$), with urban residence ($AOR=0.32$, 95% CI: 0.13–0.80, $p=0.015$), married status ($AOR=0.46$, 95% CI: 0.23–0.92, $p=0.027$), parity of three or more ($AOR=0.52$, 95% CI: 0.28–0.96, $p=0.037$), and consumption of 3–4 food groups ($AOR=0.39$, 95% CI: 0.16–0.97, $p=0.042$) associated with reduced odds of malnutrition. Conversely, initiating ANC in the third trimester ($AOR=5.87$, 95% CI: 1.07–32.17, $p=0.042$) and husband's secondary education ($AOR=1.92$, 95% CI: 1.19–3.08, $p=0.007$) increased malnutrition risk.

The Hosmer-Lemeshow test ($\chi^2(8)=4.16$, $p=0.842$) confirmed good model fit, indicating alignment between predicted and observed outcomes. Multicollinearity was minimal (mean $VIF=1.18$, all <1.4), ensuring independent predictor effects. The moderate $Pseudo R^2$ (0.0735) and wide CI for third-trimester ANC suggest additional factors, such as socioeconomic status, could enhance explanatory power.

Findings from the binary logistic regression analysis indicated that residence, marital status, husband's educational status, parity, timing of first ANC visit, and dietary diversity were significantly associated with malnutrition among pregnant women ($p\text{-value} < 0.05$).

According to the results, pregnant women living in urban areas were 68% less likely to be malnourished compared to those residing in rural areas ($AOR: 0.32$, 95% CI: 0.13–0.80). Similarly, being married reduced the likelihood of being malnourished by 54% compared to being single ($AOR: 0.46$, 95% CI: 0.23–0.92). Husband's educational status was significantly associated with maternal nutritional status. Pregnant women whose husbands attended only secondary education were nearly 2 times more likely to be malnourished compared to those whose husbands had higher education ($AOR: 1.92$, 95% CI: 1.19–3.08). Parity also showed a significant relationship with nutritional status. Women with three or more children were 48% less likely to be malnourished compared to those with one to two children ($AOR: 0.52$, 95% CI: 0.28–0.96).

Timing of the first ANC visit was another important factor. Pregnant women who started their ANC follow-up in the third trimester were nearly 6 times more likely to be malnourished compared to those who began in the second trimester ($AOR: 5.87$, 95% CI: 1.07–32.17). Lastly, dietary diversity was significantly associated with nutritional status. Pregnant women who consumed a diet with 3–4 food groups were 61% less likely to be malnourished compared to those consuming only 1–2 food groups ($AOR: 0.39$, 95% CI: 0.16–0.97) (Table 5).

Table 5: Distribution of Factors Associated with Nutritional Status among Pregnant Women Attending Prenatal Care at Mekelle General Hospital, 2025 (n=408)

Variables	Category	Malnutrition		COR (95% CI)	AOR (95% CI)	P-value
		Yes	No			
Age Group	18–29	111 (42.86)	148 (57.14)	Reference	Reference	
	30–39	56 (39.72)	85 (60.28)	0.88 (0.58–1.33)	1.13 (0.67–1.89)	0.646
	40–59	1 (12.50)	7 (87.50)	0.19 (0.02–1.57)	0.32 (0.03–2.98)	0.317
Residence	Rural	17 (68.00)	8 (32.00)	Reference	Reference	
	Urban	151 (39.43)	232 (60.57)	0.31 (0.13–0.73)	0.32 (0.13–0.80)	0.015
Marital Status	Single	25 (59.52)	17 (40.48)	Reference	Reference	
	Married	143 (39.07)	223 (60.93)	0.44 (0.23–0.84)	0.46 (0.23–0.92)	0.027
Husband's Education	No formal education	19 (51.35)	18 (48.65)	2.21 (1.07–4.56)	1.90 (0.86–4.18)	0.112
	Primary	24 (40.00)	36 (60.00)	1.40 (0.76–2.57)	1.45 (0.75–2.80)	0.269
	Secondary	72 (48.98)	75 (51.02)	2.01 (1.27–3.19)	1.92 (1.19–3.08)	0.007
	Higher	53 (32.32)	111 (67.68)	Reference	Reference	
Parity	First	64 (46.38)	74 (53.62)	1.15 (0.74–1.79)	1.05 (0.64–1.73)	0.837
	1–2	79 (42.93)	105 (57.07)	Reference	Reference	
	3 or more	25 (29.07)	61 (70.93)	0.54 (0.31–0.94)	0.52 (0.28–0.96)	0.037
First ANC Visit	1st trimester	96 (42.29)	131 (57.71)	1.19 (0.79–1.78)	1.31 (0.85–2.02)	0.224
	2nd trimester	66 (38.15)	107 (61.85)	Reference	Reference	
	3rd trimester	6 (75.00)	2 (25.00)	4.86 (0.95–24.81)	5.87 (1.07–32.17)	0.042
Dietary Diversity	1–2	161 (42.59)	217 (57.41)	Reference	Reference	
	3–4	7 (23.33)	23 (76.67)	0.41 (0.17–0.98)	0.39 (0.16–0.97)	0.042

6. Discussion

Malnutrition during pregnancy remains a critical public health challenge in Ethiopia, contributing to adverse birth outcomes such as low birth weight and preterm delivery, particularly in regions like Tigray facing food security constraints. The study aims to assess the prevalence of malnutrition and examine the associated factors among pregnant women attending prenatal care at Mekelle General Hospital in 2025. This study showed that 41.2% [95% CI: 36.4%, 46.0%] of the participants were malnourished, with a 95% Confidence Interval (CI). Pregnant women residing in rural areas were more likely to be malnourished compared to their urban counterparts. Similarly, unmarried women experienced a higher risk of malnutrition possibly reflecting lower levels of social and economic support. The educational background of husbands also emerged as an important factor, with lower education levels linked to higher maternal nutritional risk.

The prevalence of malnutrition in this study was higher than that reported in studies conducted in Alamata, eastern Ethiopia, and southern Ethiopia, where undernutrition was assessed among pregnant women using MUAC or similar criteria. The discrepancy may be attributed to differences in study settings, sample characteristics, or MUAC cut-off points applied across these studies. However, the prevalence in this study is comparable to that observed in the Oromia Region, suggesting similar nutritional challenges in certain Ethiopian contexts. In contrast, a higher prevalence was noted in other southern Ethiopian regions. These findings reflect the unique socio-economic, cultural, and healthcare context of Mekelle, a city in Ethiopia's Tigray region with a mixed urban-rural population. Mekelle's setting contributes to the observed malnutrition patterns, primarily because the region's ongoing food security challenges, exacerbated by conflict and economic instability in Tigray, limit access to diverse and nutrient-rich foods.

Dietary practices significantly influenced nutritional outcomes. Women consuming 3–4 food groups were 61% less likely to be malnourished compared to those with 1–2 groups (AOR=0.39, 95% CI: 0.16–0.97, $p=0.042$), consistent with findings in southern Ethiopia and Nigeria(103,104). This protective effect likely stems from increased intake of micronutrients like iron and folate, essential for maternal health. In Mekelle, low dietary diversity may reflect economic barriers and reliance on staple crops like teff, aligning with the Seqota Declaration's emphasis on diversifying diets to improve maternal nutrition(105). These findings highlight the need for nutrition education programs to enhance dietary variety, particularly for resource-constrained households.

Socio-demographic factors were pivotal in shaping nutritional status, as confirmed by a robust logistic regression model ($n=408$, LR $\chi^2(12)=40.64$, $p<0.001$, Pseudo $R^2=0.0735$). Urban residence reduced

malnutrition odds by 68% (AOR=0.32, 95% CI: 0.13–0.80, $p=0.015$), likely due to better access to healthcare facilities and diverse food markets in Mekelle’s urban areas, as seen in eastern Ethiopia and Kenya (106,107). Rural women face challenges like long distances to clinics and limited food resources, increasing their vulnerability. Married women were 54% less likely to be malnourished (AOR=0.46, 95% CI: 0.23–0.92, $p=0.027$), possibly due to shared household resources and cultural norms in Tigray prioritizing pregnant women’s nutrition, a pattern observed in Nigeria (104). Women with three or more prior pregnancies had 48% lower odds of malnutrition (AOR=0.52, 95% CI: 0.28–0.96, $p=0.037$), reflecting greater experience in managing nutritional needs during pregnancy, consistent with eastern Ethiopia (106). Conversely, women whose husbands had secondary education faced a 1.92-fold increased risk (AOR=1.92, 95% CI: 1.19–3.08, $p=0.007$), potentially due to intermediate socioeconomic status lacking the resources or nutritional awareness of higher-educated households, as noted in Oromia (108). Late antenatal care (ANC) initiation in the third trimester increased malnutrition odds nearly 6-fold (AOR=5.87, 95% CI: 1.07–32.17, $p=0.042$), likely due to missed opportunities for nutritional counseling, aligning with studies in Nigeria and Kenya (104,107). These findings support the Seqota Declaration’s focus on early ANC and community-based nutrition interventions to address maternal malnutrition (105).

The model’s validity was confirmed by diagnostic tests. The Hosmer-Lemeshow test ($\chi^2(8)=4.16$, $p=0.842$) indicated good fit, showing alignment between predicted and observed malnutrition outcomes. Minimal multicollinearity (mean VIF=1.18, all <1.4) ensured independent predictor effects, and Wald tests validated significant predictors (e.g., urban residence: $z=-2.43$, $p=0.015$; third-trimester ANC: $z=2.04$, $p=0.042$). Data were collected via MUAC and BMI measurements and structured surveys on dietary diversity and socio-demographic factors, but challenges included possible recall bias in dietary reporting and limited third-trimester ANC cases. These findings underscore the need for policy interventions aligned with the Seqota Declaration, such as mobile health units for rural women and enhanced nutritional counseling in early ANC (105). Future research should incorporate additional socioeconomic variables and validate findings across Ethiopia to inform comprehensive maternal nutrition strategies.

7. Strengths and Limitations

7.1. Strength

- Employed logistic regression with adjusted odds ratios, controlling for multiple socio-demographic factors, enhancing the robustness of identified associations.
- The study utilized both anthropometric measurements (e.g., BMI, MUAC) and self-reported data (e.g., dietary practices, socioeconomic factors), allowing for a holistic assessment of nutritional status.
- The study Focus on Vulnerable Population, by targeting pregnant women attending prenatal care, the study addresses a critical period where nutritional interventions can have significant impacts on both maternal and fetal health.
- Institution-Based study allowing the collection of data from individuals at different stages of pregnancy and capturing diverse health and nutrition profiles.

7.2. Limitation

- Limited resources affected the depth of nutritional assessments more detailed biochemical or clinical assessments of micronutrient deficiencies could not be conducted.
- BMI was ineffective for assessing nutritional status in pregnant women due to physiological changes (e.g., weight gain, fluid retention), limiting its utility compared to MUAC.
- Institution-Based study may not reflect the true prevalence of maternal malnutrition at the community level.
- Data were collected at one point in time, which limits the ability to capture seasonal variations, temporal changes, or the influence of evolving factors over time.
- Dietary intake and socioeconomic characteristics were self-reported by participants, making them subject to recall bias and social desirability bias, which may affect the accuracy of the data.

8. Conclusion and Recommendations

8.1 Conclusion

In conclusion, this study clearly indicated that the prevalence of malnutrition among pregnant women attending antenatal care at Mekelle General Hospital was high (41.2%), which is a significant public health concern. This may be attributed to poor dietary practices, limited dietary diversity, and delayed initiation of antenatal care.

Factors those were significantly associated with malnutrition included residence, marital status, husband's educational level, parity, timing of first ANC visit, and dietary diversity. Pregnant women living in urban areas, those who were married, had three or more children, initiated ANC visits in earlier trimesters, and practiced better dietary diversity were less likely to be malnourished. On the other hand, having a husband with only secondary education and starting ANC in the third trimester were associated with higher odds of malnutrition. These results underscore the need for targeted nutrition education, promotion of early ANC visits, and interventions aimed at improving dietary diversity and male involvement in maternal health to address the burden of malnutrition among pregnant women.

8.2. Recommendations

From the descriptive and inferential analyses of malnutrition among pregnant women at Mekelle General Hospital, public health interventions should adopt a multifaceted approach to address nutritional deficiencies, financial challenges, and socio-demographic disparities influencing maternal health. The following recommendations are proposed:

- **Enhance Dietary Diversity:** Implement community education programs that encourage the consumption of a wider variety of food groups, particularly focusing on iron-rich and dairy foods to combat prevalent deficiencies.
- **Promote Nutritional Counseling:** Offer individualized nutritional counseling during antenatal care visits to help pregnant women understand the importance of a balanced diet and how to incorporate diverse foods into their meals.
- **Community-Based Nutrition Education Programs:** Develop programs that promote the consumption of varied, nutrient-rich, and affordable foods—such as legumes, vegetables, and fruits—especially for women with limited dietary variety. These programs should also provide subsidies to offset financial barriers faced by low-income households in accessing these foods.
- **Increase Accessibility to Nutrient-Rich Foods:** Collaborate with local farmers and markets to improve access to fresh fruits, vegetables, and other nutrient-rich foods, particularly in urban areas where availability may be limited.

- **Mobile Antenatal Care Clinics:** Deploy mobile antenatal care clinics to rural areas where women are at greater nutritional risk. These clinics should provide Mid-Upper Arm Circumference (MUAC)-based nutritional screening, dietary counseling, and micronutrient supplementation to ensure accessibility despite financial and logistical constraints.
- **Support for Vulnerable Groups:** Create specific support programs for single mothers, who are more vulnerable to undernutrition. This should include targeted initiatives such as nutritional subsidies and community support groups to enhance their access to diverse foods and health services, addressing both social and economic stressors exacerbated by low household income.
- **Address Financial Challenges:** Develop financial assistance programs that can help low-income families afford nutritious foods. This could include food vouchers or direct financial support for purchasing essential food items that are rich in nutrients necessary for maternal health.
- **Encourage Early Antenatal Care Attendance:** Launch public health campaigns that emphasize the importance of early prenatal care attendance. This is particularly crucial for first-time mothers who may lack dietary management experience compared to those with multiple pregnancies. Efforts should be paired with financial assistance programs to enable low-income women to engage with health services.
- **Targeted Support for First-Time Mothers:** Develop specific educational initiatives aimed at first-time mothers, focusing on dietary management during pregnancy. These initiatives should provide practical guidance on nutrition, meal planning, and cooking skills, ensuring that these efforts are paired with financial assistance programs. This approach will help empower first-time mothers with the knowledge and resources they need to make informed dietary choices.

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Annex I: English Version

Patient Consent Form

Name of the principal investigator: Helen Araya

Name of study area: Mekelle Hospital

Research budget covered by: Self-sponsored

Research objective: To assess the prevalence of malnutrition among pregnant women attending prenatal care and identify the associated factors influencing their nutritional status.

Significance of the study: This study will provide essential baseline data on malnutrition among pregnant women attending prenatal care, helping healthcare professionals, policymakers, and community stakeholders understand its prevalence and contributing factors. By raising awareness, the findings will support targeted nutritional interventions, inform healthcare policies, and encourage integrating comprehensive nutritional care into prenatal services. Ultimately, this research aims to enhance maternal and infant health outcomes through evidence-based nutrition practices in the healthcare system..

Study procedure: Data specific to each participant will be collected using a structured data collection tool to assess nutritional status and identify associated factors influencing malnutrition among pregnant women. This will include collecting information on socioeconomic status, dietary diversity, meal frequency, physical activity, and relevant demographic characteristics. Nutritional assessments, such as Body Mass Index (BMI) and Mid-Upper Arm Circumference (MUAC), will be conducted to evaluate malnutrition levels. The data gathered will help determine whether the nutritional needs of pregnant women are being met, ensuring their access to adequate and balanced nutrition during pregnancy.

Risks: No risks except the time that patient spend during the interview.

Participant right: The patient has a right to stop the interview at any time, or to skip any question that he/she does not want to answer.

Benefit: This study is beneficial for pregnant women by supporting improved nutritional care in future visits. It informs healthcare providers about the prevalence and factors of malnutrition, enhancing their ability to address nutritional needs effectively. Additionally, the findings serve as a valuable resource for the hospital and

policymakers, guiding the development of targeted nutrition programs and informing broader healthcare policy to support maternal and fetal health.

Incentives: You will not be provided any specific incentive for taking part in the research other than acknowledgment.

Confidentialities: The study result will not include patient's name and address and any information communicated will be kept confidential.

Agreement: Patients are expected to be fully voluntary to participate in the study.

Whom to contact: If you have any kind of inconveniencies about the study, you can contact the following individual: Helen Araya: Cell Phone: 0949729343 or helenarayabay@gmail.com.

Card number_____ Code number_____

Name of the data collector: _____ Signature: _____ date_____

Name of the principal investigator: _____ Signature: _____ date_____

Thank you for your participation and cooperation

Informed Consent

My name is Sr. / Ato -----

I am data collector for master student Helen Araya currently working his research work for graduation in health economics in Addis Ababa University, College of Health Sciences, and Department of health economics.

The objective of the research is to assess the prevalence of malnutrition among pregnant women attending prenatal care and identify the associated factors influencing their nutritional status. I would like to assure you that the study is confidential and secure I will not keep a record of your name and address. You have a right to stop the interview at any time, or to skip any question that you do not want to answer. Your correct answer to the questions can make the study achieve its goals. Therefore, you are kindly requested to respond genuinely and voluntary with patience. The interview may take few minutes. I would greatly appreciate your help in responding to this study.

Result of the interview:

1. Completed
2. Partially completed
3. The interviewee refused
4. Others

Data collection tool

Addis Ababa University, College of Health Sciences, Department of health economics

Data collection tool to assess Prevalence of malnutrition and associated factors among pregnant women attending prenatal care in Mekelle General Hospital

Section 1: Socio- economic and Demographic factors

Question Number	Variable	Response Options
1	Age	_____
2	Residence	☐ Rural ☐ Urban
3	Religion	☐ Orthodox ☐ Protestant ☐ Muslim ☐ Other
4	Education Level	☐ No formal education ☐ Primary ☐ Secondary ☐ Higher
5	Husband's Educational Level	☐ No formal education ☐ Primary ☐ Secondary ☐ Higher
6	Marital Status	☐ Single ☐ Married ☐ Divorced ☐ Widowed
7	Employment Status	☐ Employed (specify): _____ ☐ Unemployed ☐ Self-employed
8	Income Level	_____
9	Parity	☐ First ☐ 1-2 ☐ 3 or more
10	Food Access Difficulty	☐ Yes ☐ No

11	Financial Nutrition Challenges	☐ Yes ☐ No
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Section 2: Reproductive Health Characteristics, Healthcare Access and Utilization

Question Number	Variable	Response Options
12	Gestational Age?	<12 weeks ☐ 24 weeks ☐ 12–24 weeks ☐ Above 24 weeks ☐
13	First ANC Visits	☐ 1st trimester ☐ 2nd trimester ☐ 3rd trimester
14	Number of prenatal care visit	_____
15	Health care provider's schedule?	☐ Yes ☐ No
16	Distance to Healthcare Facility	_____ (specify km)
17	Transportation Mode	☐ Walking ☐ Bicycle ☐ Public transport ☐ Other
18	Dietary Information Source	☐ Healthcare ☐ Media ☐ Family/Friends ☐ None
19	Nutritional Counseling	☐ Yes ☐ No

Section 3: Dietary practice, Supplement use and Lifestyle Factors

Question Number	Variable	Response Options
20	Dietary Diversity	☐ 1–2 ☐ 3–4 ☐ 5+
21	Meal Frequency	☐ 1 ☐ 2 ☐ 3 ☐ 4+
22	Snack Consumption	☐ Never ☐ Rarely ☐ Often ☐ Daily
23	Supplement Use	☐ Yes, regularly ☐ Occasionally ☐ No
24	Water Intake	☐ 1–3 ☐ 4–6 ☐ 7–9 ☐ 10+
25	Supplement Type	☐ Iron ☐ Folic Acid ☐ Multivitamins ☐ None
26	Protein Consumption	☐ Daily ☐ 3–5 times ☐ Rarely
27	Vitamin Consumption	☐ Daily ☐ 3–5 times ☐ Rarely
28	Iron-Rich Foods	☐ Daily ☐ 3–5 times ☐ Rarely
29	Carbohydrate Consumption	☐ Daily ☐ 3–5 times ☐ Rarely

30	Dairy Consumption	☐ Daily ☐ 3–5 times ☐ Rarely
31	Alcohol Consumption	☐ Yes ☐ No
32	Khat Consumption	☐ Yes ☐ No
33	Smoking	☐ Yes ☐ No
34	Coffee Consumption	☐ Yes ☐ No

Section 4: Anthropometric Measurements

Question Number	Section	Variable	Response Options
35	Anthropometric Measurements	BMI	_____ kg/m ²
36		MUAC	_____ cm

Annex II.: Tigrinya Version

ናይ ሕሙማት ስምምዕ ፎርም

ስም እታ ቐንዲ መርማሪት ፡- ሄለን ኣርአያ

ስም ናይ መጽናዕቲ ቦታ - ሆስፒታል መቐለ

ብገዛእ ርእሰኝ ዚምወል ባጀት ምርምር

ዕላማ ምርምር:- ጉድለት ኣመጋግባ እተን ቅድሚ ሕርሲ ዚከናኸና ነፍሰ ጸር ንምግምጋምን ንኹነታት ኣመጋግባኡን ዚጸልዎ ረጃቢታት ንምልላይን እዩ።

ኣገዳስነት እቲ መጽናዕቲ:- እዚ መጽናዕቲ እዚ ብዛዕባ ጉድለት ኣመጋግባ እተን ቅድሚ ሕርሲ ዚከናኸና ነፍሰ ጸር ዚገልጽ መሰረታዊ ሓበሬታ ኺህብ እዩ፤ እዚ ኸኣ ንሰብ ሞያ ኸንክን ጥዕናን ነቶም ፖሊሲ ዜውጽኡ ሰባትን ንማሕበረሰብ ዜካይዱ ሰባትን ነቲ ኣስፋሕፊሑ ኣበርክቶ ዚገብርን ረጃቢታት ንኺርድእም ኺሕግዞም እዩ። እዚ ርኽበታት እዚ ንተገዳስነት ሰባት ብምልዕዓል ዕላማ እተገብረ ናይ ኣመጋግባ ጣልቃ ምእታው ፖሊሲታት ክንክን ጥዕና ምሕባር ከምኡውን ሰፊሕ ክንክን ኣመጋግባ ምስ ኣገልግሎት ሕርሲ ምትሕንፋጽ ዘተባብዕ ኢዩ። ኣብ መወዳእትኡ እዚ መጽናዕቲ እዚ ኣብ ኣገባብ ክንክን ጥዕና ኣብ መርትዖ እተመርኩሰ ኣመጋግባ ብምግባር ነቲ ናይ ኣዲእን ሕጻናትን ጥዕና ዘምጽኡ ውጽኢት ንምምሕያሽ ዝዓለመ ኢዩ።

ኣሰራርሓ መጽናዕቲ:- ንነፍሲ ወከፍ ተሳታፊ ዚምልከት ሓበሬታ ኩነታት ኣመጋግባ ንምግምጋምን ንጉድለት ኣመጋግባ ነፍሰ ጸር ዚጸልዎ ምስኡ ዚተሓሓዝ ረጃቢታት ንምልላይን እተወደበ ሓበሬታ ንምእካብ ዚሕግዝ መሳርሒ ኺእከብ እዩ። እዚ ኸኣ ብዛዕባ ማሕበራዊ ቊጠባዊ ኹነታት በበይኑ ዝዓይነቱ ኣመጋግባ ቊጽሪ ምግባር ኣካላዊ ምውስዎስ ኣካላት ከምኡውን ምስኡ ዝተሓሓዝ ጂኦግራፊያዊ ባህርያት ሓበሬታ ምእካብ ዘጠቓልል ኢዩ ። ከም እኒ ቦዲ ማስ ኢንደክስ (BMI) ከምኡውን ማእከላይ-ኣፕር ኣርም ሲርክፈረንስ (MUAC) ዝኣመሰለ ናይ ኣመጋግባ ገምጋም ንጉድለት ኣመጋግባ ንምግምጋም ክግበር ኢዩ። እቲ እተኣከበ ሓበሬታ ጥኑሳት ኣንስቲ ኣብ እዋን ጥንስቲ እኹልን ሚዛናውን ምግባር ንኺረኽባ ዜድልዩን ምግባር ይማልኣለን እንተ ኣልዩ ንምውሳን ይሕግዝ።

ጥቕሚ:- እዚ መጽናዕቲ እዚ ኣብ መጻኢ ኣብ ዚግበር ምብጻሕ ንጥኑሳት ደቂ ኣንስትዮ ዝሓሸ ኸንክን ኣመጋግባ ብምድጋፍ ጠቓሚ እዩ። ብዛዕባ እቲ ኣስፋሕፊሑ ዘሎ ንጉድለት ኣመጋግባን ረጃቢታትን ነቶም ሰብ ሞያ ኸንክን ጥዕና ትሕብሮም ፣ እዚ ኸኣ ነቲ ዜድልዮም ኣመጋግባ ብውጽኢታዊ መገዲ ንምምላእ ዘለዎም ክእለት ዩደንፍዎም ። ብተወሳኺውን እዚ ርኽበታት እዚ ነቲ ግቡእ መደባት ኣመጋግባ ንምምሕያሽ ከምኡውን ንጥዕና ኣደን ዕሽልን ንምድጋፍ ዝሰፍሐ ፖሊሲ ኸንክን ጥዕና ንምሕባር ነቶም ሆስፒታልን ፖሊሲ ዜውጽኡ ሰባትን ጠቓሚ ምንጪ ኹይንዎም ኣሎ።

መተባብሩ:- ኣብቲ ምርምር ንኸትካፈል ዚድርኽካ ነገር ኣፍልጦ ኻብ ምሃብ ሓሊፉ ካልእ ነገር ኣይኪወሃበካን እዩ።

ምስጢር:- እቲ ውጽኢት መጽናዕቲ ስምን ኣድራሻን እቲ ሕሙም ኣየጠቓልልን እዩ፤ ዝኹን ይኹን ዚመሓለፈሉ ሓበሬታ ድማ ምስጢር ከይኑ ይተሓዝ።

ስምምዕ:- ሕሙማት ኣብቲ መጽናዕቲ ምሉእ ብምሉእ ብፍታው ኪሳተፉ ትጽቢት ይግበረሎም እዩ።

ምስ መን ክትራኽብ ኣሎካ? ብዛዕባ እቲ መጽናዕቲ ገለ ጸገም እንተ ኣልዩካ ምስዚ ዚስዕብ ውልቀ-ሰብ ክትራኽብ ትኽእል

ኢኻ:- ሄለን ኣርኣያ :- ሞባይል ተሌፎን:- 0949729343 ወይ helenarayabay@gmail.com።

ቼጽሪ _____ ኮድ ቼጽሪ _____ ካርድ

ስም እቲ አከብቲ ሓበሬታ:- _____ ክታም:- _____ ዕለት _____

ስም እቲ ቅንዲ መርማሪ:- _____ ክታም:- _____ ዕለት _____

ስለቲ ዝገበርኩምለይ ተሳትፎን ምትሕብባርን አመስግነኩም

እተፈልጠ ፍቓድ

ስመይ ጂንዩር / አቶ -----

ሄለን ኣርአያ እትበሃል ክኢላ ተማሃሪት ኣብዚ እዋን እዚ ኣብ ዩኒቨርሲቲ አዲስ አበባ ኮለጅ ስነ-ፍልጠት ጥዕና ከምኡውን ክፍሊ ቅጠባ ጥዕና ኣብ ምረቃ ናይ ምርምር ዕዮኡ ትጻዪ ኣላ።

ዕላማ እቲ መጽናዕቲ ጉድለት አመጋግባ እተን ቅድሚ ሕርሲ ዚከናኸና ጥኑሳት ንምግምጋምን ንኹነታት አመጋግባእን ዚጸልዎ ረቂቒታት ንምልላይን እዩ። እቲ መጽናዕቲ ምስጢራውን ዜተአማምንን ምኃኑ ስምካን ኣድራሻኻን ከም ዘይጽሕፍ ከረጋግጸልኩም እደሊ ። ኣብ ዝኹነ ይኹን እዋን ነቲ ቻለ-መጠይቕ ከተቋርጸ ወይ ክትምልሶ ዘይትደሊ ዝኹነ ይኹን ሕቶ ኸተቋርጸ መሰል ኣሎካ። ነቲ ሕቶታት እትህቦ ቕኑዕ መልሲ ነቲ መጽናዕቲ ሸቶታቱ ኸም ዚወቅዕ ኪገብሮ ይኸእል እዩ ። ስለዚ ብትዕግስትን ብፍታውን ምላሽ ክትህብ ብሕያውነት ትሕተት ኢኻ ። እቲ ቻለ-መጠይቕ ሒደት ደቓይቕ ኪወስድ ይኸእል እዩ። ነዚ መጽናዕቲ እዚ ምላሽ ንኸትህቡሉ ዝገበርካለይ ሓገዝ ኣዝዩ እዩ ዘማስወሉ ።

ውጽኢት ናይቲ ቃለ - መጠይቕ -

1. ተዛዚሙ
2. ብኸፊል ተዛዘመ
3. እቲ ቻለ መጠይቕ እተገብረሉ ሰብ ኣበዩ
4. ኻልኣት _____

ሓበሬታ ንምእካብ ዚሕግዝ መሳርሒ

ዩኒቨርሲቲ አዲስ አበባ ኮለጅ ስነ ፍልጠት ጥዕና ክፍሊ ቅጠባ ጥዕና

ጉድለት አመጋግባን ምስኡ እተተሓሓዘ ረቂቒታትን ኣብተን ኣብ መከል ጀነራል ሆስፒታል ቅድሚ ሕርሲ ዚካፈላ ነፍሶ ጸር ንምግምጋም ዚሕግዝ ሓበሬታ ንምእካብ ዚሕግዝ መሳርሒ

1ይ ክፋል:- ማሕበረሰብን ደሞክራሲያውን ረቂቒታት

ቼፀሪ	ተመን	ምላሽ ምርጫታት
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1	ዕድመ	_____
2	መንበሪ	☐ አብ ከባቢ ኸተማ ☐ ገጠር
3	ሃይማኖት	☐ ኦርቶዶክስ ☐ ፕሮተስታንት ☐ ምስልምና ☐ ካልእ
4	ደረጃ ትምህርቲ ኣደ	☐ ዘይተማሃረ ትምህርቲ ☐ መባእታዊ ☐ ካልኣይ ደረጃ ☐ ዚወሃብ ወግዓዊ ትምህርቲ የልቦን
5	ደረጃ ትምህርቲ ሓዳር	☐ ዘይተማሃረ ትምህርቲ ☐ መባእታዊ ☐ ካልኣይ ደረጃ ☐ ዚወሃብ ወግዓዊ ትምህርቲ የልቦን
6	ኩነታት ሓዳር	☐ ተመርዓወ ☐ ዘይተመርዓወ ☐ እተፋትሐት ☐ መበለት ተመርዓወት
7	ኩነታት ስራሕ	☐ ናይ ቀረባ ግዜ ስራሕ ዘለዎ ☐ ስራሕ ዘይብሎም ☐ ገዛእ ርእሶም ዚሰርሑ
8	ወርሓዊ ኣታዊ ስድራ ቤት	_____
9	ቁጽሪ ውላድ	☐ ቀዳማይ ☐ 1-2 ☐ 3 ወይ ካብኡ ንላዕሊ
10	ኣልኮላ	☐ 'እው' ☐ ኣይኮነን
11	ካት	☐ 'እው' ☐ ኣይኮነን
12	ሽጋራ	☐ 'እው' ☐ ኣይኮነን
13	ቡን	☐ 'እው' ☐ ኣይኮነን

2ይ ክፋል፡- ክንክን ጥዕናን ኣጠቓቕማኡን

ቐፅሪ ሕቶ	ክፍሊ	ተመን	ምላሽ ምርጫታት
14	ክንክን ጥዕናን ኣጠቓቕማኡን	እቲ መጀመርታ ግዜ ኣብ ዝገበርካዮ	☐ 1ይ ትሪማስተር ☐ 2ይ ትሪማስተር ☐ 3ይ ሰለስተ ዕጽፊ

		ምብጻሕ	
15		ቁጽረ ናይ ቅድመ- ወሊድ ክንክን ምብጻሕ	_____
16		መደብ ናይ ኣቅራቢ ክንክን ጥዕና	☐ 'እው' ☐ ኣይኮነን
17		ርሕቀት ናብ ትካል ክንክን ጥዕና	_____ (ኪ. ሜ)
18		ዓይነት ትራንስፖርት	☐ ህዝባዊ መጓዓዝያ ብሽክለታ ☐ ብእግርኻ ምኻድ ☐ ብመንገዲ ስር ምስተ ዘለኻ

ክፋል 3:- ረጅሒታት ኣመጋግባን ኣነባብራን

ቁፅረ ሕቶ	ሕቶ	ምላሽ ምርጫታት
19	ኣብ መዓልቲ ኸንደይ እተፈላለዩ ዓይነት ምግቢ ኢኻ እትምገብ?	☐ 1-2 ☐ 3-4 ☐ 5+
20	ኣብ መዓልቲ ኸንደይ ሳዕ ኢኻ እትምገብ?	☐ 1 ☐ 2 ☐ 3 ☐ 4+
21	ኣብ መንጎ መኣዲ ጥዑም ምግቢ ትበልዕ ዲኻ?	☐ መዓልታዊ ☐ ሳሕቲ እንተ ዘይኮይኑ ☐ ዘይኮነን
22	ኣብ እዋን ጥንስቲ ተወሳኺ ነገራት ትወስድ ዲኻ?	☐ ሓላፊ ☐ ኣይኮነን
23	ኣብ መዓልቲ ኸንደይ ብርጅቆ ማይ ኢኻ እትበልዕ?	☐ 1-3 ☐ 4-6 ☐ 7-9 ☐ 10+
24	ኣብዚ እዋን እዚ ተወሳኺ ዓይነት ኣመጋግባ ትወስድዶ ኣለኻ? ኣብ ጥቓኡ ዚርከብ	☐ ሓጺን ☐ ፎሊክ ኣሲድ ☐ ማልቲቪታሚናት
25	ኣብ ዝሓለፈ ሰሙን ክንደይ ሳዕ ኢኻ ፕሮቲን ዝሓዘ ምግቢ እትበልዕ ኔርካ?	☐ ደይሊ ☐ 3-5 ሳዕ ሳሕቲ እንተ ዘይኮይኑ ☐ ሳሕቲ እንተ ዘይኮይኑ
26	ኣብ ዝሓለፈ ሰሙን ክንደይ ሳዕ ኢኻ ቪታሚን ዝሓዘ ምግቢ እትበልዕ?	☐ ደይሊ ☐ 3-5 ሳዕ ሳሕቲ እንተ ዘይኮይኑ ☐ ሳሕቲ እንተ ዘይኮይኑ

27	አብ ዝሓለፈ ሰሙን ክንደይ ሳዕ ኢኹ ብሓጺን እተሰርሐ ምግብ እትበልዕ ኔርካ?	☐ ደይሊ ☐ 3-5 ሳዕ ሳሕቲ እንተ ዘይኮይኑ ☐ ሳሕቲ እንተ ዘይኮይኑ
28	አብ ዝሓለፈ ሰሙን ክንደይ ሳዕ ኢኹ ካርቦሃይድሬት እትበልዕ ኔርካ?	☐ ደይሊ ☐ 3-5 ሳዕ ሳሕቲ እንተ ዘይኮይኑ ☐ ሳሕቲ እንተ ዘይኮይኑ
29	አብ ዝሓለፈ ሰሙን ክንደይ ሳዕ ኢኹ ፍርያት ጸባ እትበልዕ ኔርካ?	☐ ደይሊ ☐ 3-5 ሳዕ ሳሕቲ እንተ ዘይኮይኑ ☐ ሳሕቲ እንተ ዘይኮይኑ
30	ምንጪ ኣመጋግባ ኹበይ ኢኹ ብዛዕባ ኣመጋግባ ሓበሬታ እትረክብ?	☐ ኸንክን ጥዕና ☐ መራኽቢ ብዙሓን ☐ ስድራ ቤትን ፈተውትን
31	አብ ዝሓለፈ ወርሒ እኹል ምግብ ምርከብ ኣጸጊሙካዶ?	☐ 'እወ' ☐ ኣይኮነን
32	ቅድሚ ሕርሲ ኣብ እትገብሮ ምብጻሕ ብዛዕባ ኣመጋግባ ምኽሪ ተዋሂቡካዶ ኣሎ?	☐ 'እወ' ☐ ኣይኮነን
33	መኣዛታት ዘለዎ ምግብ ንምርካብ እንታይ ብድሆታት እዩ ዜጋጥመካ?	ግንዘባዊ ☐ ኣቅራቦት ☐ ካልኦት ☐
34	ገንዘባዊ ንጥፍነት ፀገማት	☐ 'እወ' ☐ ኣይኮነን

ክፋል 4:- ሰብኣዊ መለክዒ

ጭቅሪ ሕቶ	ክፍሊ	ተመን	ምለሽ ምርጫታት
35	ሰብኣዊ መለክዒ	BMI	_____ ኪሎ/ሜ ²
36	ሰብኣዊ መለክዒ	MUAC	_____ ሰንቲ ሜተር